

INVESTIGATION OF NUTRITIONAL VALUES, ACUTE TOXICITY AND HYPOGLYCEMIC ACTIVITIES ON TWO CULTIVARS OF *LYCOPERSICON ESCULENTUM* MILL.

Than Than Yee¹

Abstract

Lycopersicon esculentum Mill. belongs to the family Solanaceae. It is known as the kha yan gyin in Myanmar. Two cultivars of *Lycopersicon esculentum* Mill., cv. local and cv. 909 (Taiwan) were collected from Moe Kaung village, Sintgaing Township, Mandalay Region. Morphological and histological studies on two cultivars of *Lycopersicon esculentum* Mill. were carried out, to get their correct identification. Determination of nutritional values of two cultivars such as water, carbohydrate, crude fiber, proteins and fat were also investigated. The acute toxicity study of ethanol extracts of two cultivars on albino mice were performed. The lethal effect was not observed even use of maximum does of 2500 mg/kg. The hypoglycemic effect of ethanol extracts from two cultivars on adrenaline induced hypoglycemic albino mice were tested. These two cultivars show more reduction of hypoglycemic activity than standard drug, glibenclamide. The property of reduction of blood glucose concentration of ethanol extract cv. local and cv. 909(Taiwan) and glibenclamide were compared. From the comparison, ethanol extract of cv. local can reduce hyperglycemia better than that of cv. 909(Taiwan).

Keywords: *Lycopersicon esculentum* Mill., cultivars, nutritional values, acute toxicity, hypoglycemic activities

Introduction

Lycopersicon esculentum Mill. belongs to the family Solanaceae. The tomato is native to the Andes region of South America. The tomato plant is indigenous to the western regions of tropical South America. It is an important vegetable crop grown mainly for its popular vegetable crop; is now cultivated throughout the world for its edible fruits (Ross 2001).

Some medicinal plants have been reported to be useful in diabetes worldwide and have been used empirically as antidiabetic and antihyperlipidemic remedies. More than 400 plant species having hypoglycemic activity have been available in literature. Diabetes mellitus is a serious health problem being the third greatest cause of death all over the world, and if not treated. The chronic hyperglycemia of diabetes is associated with long term damage, dysfunction and failure of various organs (Estari *et al.* 2013).

Diabetes is one of the most prevalence chronic diseases in the world. The number of diabetic people is expected to rise from present estimate of 150 million in 2025. For a long time, diabetes has been treated with several medicinal plants or their extract based on the folklore medicine. Nowadays herbal medicine are highly recommended for the treatment of diabetes inspite of other therapeutic option, which can produce serious side effect and in addition they are not safe during pregnancy. Therefore the search for the more effective and safer hypoglycemic agents has continued to be an important area of active research. Furthermore, after the recommendation made by WHO on diabetes mellitus, investigation on hypoglycemic agent from medicinal plants has become more important (Malpani *et al.* 2010).

Various studies suggest that approximately 150 million people suffer from diabetes and this number may be double by the year 2025. One fifth of the diabetics will be from India. Much

¹ Dr, Lecturer, Department of Botany, Kyaukse University

of this increase will occur in developing countries and could be due to population growth, ageing, unhealthy diets, obesity and sedentary lifestyle (Faizal *et al.* 2009).

Interestingly, over the years, dietary consumption of vegetables and fruits (tomato) rich in carotenoids has been recommended for diabetic patients to be a protective factor against hyperglycemia but dietary consumption of high tomatine unripe tomatoes has not been recommended for diabetes mellitus (Akinnuga *et al.* 2010).

In Myanmar, there is no one who had investigated the tomato from the point of view of pharmacognosy. It is necessary to be carry out pharmacognostic study on *Lycopersicon esculentum* Mill. The aims and objectives of this research are to investigate the effect of the ethanol extract of *Lycopersicon esculentum* Mill. on hypoglycemic activity and to study the acute toxicity.

Materials and Methods

Collection, Identification and Preparation of *Lycopersicon esculentum* Mill. cv. local and cv. 909 (Taiwan)

The specimens of *Lycopersicon esculentum* Mill. cv. local and cv. 909 (Taiwan) were collected from Moe Kaung village, Sintgaing Township, Kyaukse District, Mandalay Region. The collected plants were taxonomically identified with the help of references literature such as Hooker (1885) and Dassanayake (1987). The fresh specimens were pressed, dried and preserved for morphological studies.

Nutritional Values

The nutritional values such as proteins, carbohydrate and fat of the dried fruit samples of two cultivars were determined at Department of Chemistry, University of Mandalay. Kjeldahl method was used for the determination of protein content. The carbohydrate content was determined by phenol- sulfuric acid colorimetric method. The fat content was determined by using Soxhlet apparatus.

Preparation of Ethanol Extracts from the Fruits of *Lycopersicon esculentum* Mill. cv. local and cv. 909 (Taiwan)

The fruits of *L. esculentum* Mill. cv. local and cv. 909 (Taiwan) were cut into small pieces and dried in the shade. Then they were ground and 50 g of air-dried powder were percolated with 95% ethanol (500 mL) for two months. The solution was filtered and concentrated. Ethanol crude extracts (2.2 g) and (2.5 g) was obtained.

The Study of Acute Toxicity and Hypoglycemic Activity of Ethanol Extracts from the Fruits of Two Cultivars on Albino Mice

The acute toxicity and hypoglycemic activity were performed at Department of Biotechnology, Mandalay Technology University.

The lethal activity and the determination of LD₅₀ (Lethal dose) of the ethanol extracts from the fruits of *L. esculentum* Mill. cv. local and cv. 909 (Taiwan) were done according to the method of Birdi *et al.* (2006). Thirty albino mice of both sexes, weighing 20-25 g were used. Mice were fasted for the period of 12 hours. Mice were grouped into six and each group contains five mice. Five doses of the 95% ethanol extracts from the fruits of *L. esculentum* Mill. cv. local were given orally. The given doses of the extract were 0.5 g/kg, 1.0 g/kg, 1.5 g/kg, 2.0 g/kg and

2.5 g/kg body weight. The observation was done after one week. Similar procedures were done for ethanol extract of cv. 909(Taiwan).

The hypoglycemic activity of the ethanol extracts from the fruits of *L. esculentum* Mill. cv. local and cv. 909(Taiwan) were done according to the method of Malpani *et al.* (2010). Twenty albino mice of both sexes, weighing 20-25 g were used. Among them, sixteen mice were prepared as adrenaline-induced hyperglycemic albino mice. They were divided into five groups. Each group contains four mice. Control group was given distilled water. The mice in one group were orally given standard drug, glibenclamide, 0.5×10^{-3} g/kg by using syringes and needles. The mice in two groups were orally given ethanol extracts from the fruits of *L. esculentum* Mill. cv. local and cv. 909(Taiwan) (4 g/kg). The mice were subcutaneously injected with 0.2×10^{-3} g/kg body weight of adrenaline. The rests of mice were kept for normal condition. Then, glucose levels were measured at 45 minutes interval until 225 minutes.



Figure 1 Test for hypoglycemia
 (A) Mice test for hypoglycemic activity
 (B) Administration of extract to mice
 (C) Blood glucose level determination with glucometer

Results

Taxonomical Studies of *Lycopersicon esculentum* Mill. cv. local

Lycopersicon esculentum Mill. cv. local Gard. Dict. Ed. 8, 2.1768

- Family - Solanaceae
- Local name - Kha-yan-gyin
- English name - Tomato
- Flowering period - October to February

Annual herbs; up to 1 m high; stems and branches terete, hispid. Leaves imparipinnate compound, basally lyrate, 12-20 cm long; lobes ovate to lanceolate, hispid on both surfaces; petioles 5-7 cm long, hispid. Inflorescences axillary, helicoids cymes with a few flowers; peduncles 2.5-3.0 cm long, hispid. Flowers bisexual, actinomorphic, hypogynous, bright yellow; 1.2-2.4 cm in diameter; pedicels 1.0-1.5 cm long, hispid. Calyx deeply 7-8 lobed, accrescent, hispid; tube 2.0-3.5 mm long, lobes lanceolate, 4.0-7.0 mm long. Corolla rotate, 7-8 lobed; tube 3.0-5.0 mm long; lobes triangular, 7-12 mm long. Stamens 7-8, free, adnate to the base of corolla

tube; filaments filiform, 0.5-1.0 mm long; anthers dithecous, basifixed, oblong; 5-8 mm long; yellow, dehiscent by 2 apical pores. Ovary superior, ovoid, 2-4 mm long, bilocular with many ovules on the axile placentae; style filiform, 6-8 mm long, pubescent at base, yellowish green; stigma simple. Berry globose or ovoid, 4.5-7 cm in diameter, many seeded, scarlet when ripe. Seeds numerous, discoid, obscurely reniform, 4-7 mm in diameter, yellowish white.

Specimen examined : Moe Kaung Village, Sintgaing Township, Kyaukse District, Than Than Yee, October 17, 2015



Figure 2 Morphological Characters of *Lycopersicon esculentum* Mill. cv. local (A) Habit (B) Inflorescence (C) L.S of flower

Morphological Studies of *Lycopersicon esculentum* Mill. cv. 909 (Taiwan)

Annual erect herbs; up to 1.2 m high; stems and branches terete, pubescent. Leaves imparipinnate compound, basally lyrate, 12-20 cm long; lobes ovate to oblong, pubescent on both surfaces; petioles 5-7 cm long, pubescent. Inflorescences axillary, helicoid cymes with a few flowers; peduncles 2.8-3.2 cm long. Flowers bisexual, actinomorphic, hypogynous, yellow; pedicels 1.2-1.8 cm long, pubescent. Calyx deeply 5 lobed, accrescent, pubescent, tube 2.5-3.8 mm long, lobes lanceolate, 5.0-7.5 mm long. Corolla rotate, 5 lobed, tube 5-7 mm long; lobes triangular, 8-12 mm long. Stamens 5, free, adnate to the base of corolla tube; filaments filiform, 1.0-1.5 mm long, pale yellow; anthers dithecous, basifixed, oblong, 5-9 mm long, yellow, dehiscent by two apical pores, Ovary superior, oblongoid, 3-5 mm long, bilocular with many ovules on the axile placentae; style filiform, 7-9 mm long, pubescent at base, pale yellow; stigma simple. Berry oblongoid or ovoid, 5-7cm long, many seeded, scarlet when ripe. Seeds numerous, discoid, obscurely reniform, 5-6 mm in diameter, yellowish white.

Specimen examined : Moe Kaung Village, Sintgaing Township, Kyaukse District, Than Than Yee, October 9, 2016.



Figure 3 Morphological Characters of *Lycopersicon esculentum* Mill. cv. 909 (Taiwan) (A) Habit (B) Inflorescence (C) L.S of flower

Determination of Nutritional Values

The content of some nutrients such as protein, carbohydrate and fat were determined. According to the results, carbohydrate was found as major constituents in two cultivars. The results were shown and compared in Table 1.

Table 1 Nutritional Values of cv. local and cv. 909 (Taiwan) Sample

No.	Types of Nutrient	Amount (%)	
		cv. local	cv. 909 (Taiwan)
1	Water	91.17	89.06
2	Carbohydrate	56.40	61.80
3	Crude fiber	19.9	23.1
4	Protein	16.17	18.25
5	Fat	2.25	1.50

Determination of Acute Toxicity of Ethanol Extracts from the Fruits of *Lycopersicon esculentum* Mill. cv. local and cv. 909 (Taiwan)

The mice were treated with different doses of ethanol extract from the fruits of *L. esculentum* Mill. cv local. The different mice were also treated with different doses of ethanol extract from the fruits of *L. esculentum* Mill. cv. 909 (Taiwan). After one week acute toxicity on mice were studied. The results were shown in Table 2 and 3.

It was found that all mice were alive when even 2.5 g of ethanol extract from the fruits of *L. esculentum* Mill. cv local was given to the mice. Therefore, the LD₅₀ of the extract supposed to be much more than 2.5 g/kg body weight.

Table 2 Effect of Ethanol Extract of *Lycopersicon esculentum* Mill. cv. local on Acute Toxicity

Groups	Number of Mice	Dosage (oral) mg/kg Body wt.	Ratio of Dead and Tested	% of Death
1	5	Distilled water	0/5	0%
2	5	Ethanol extract 0.5 g/kg body wt.	0/5	0%
3	5	Ethanol extract 1.0 g/kg body wt.	0/5	0%
4	5	Ethanol extract 1.5 g/kg body wt.	0/5	0%
5	5	Ethanol extract 2.0 g/kg body wt.	0/5	0%
6	5	Ethanol extract 2.5 g/kg body wt	0/5	0%

Diet = Stock diet & distilled water
Observation period= one week

Table 3 Effect of Ethanol Extract of *Lycopersicon esculentum* Mill. cv. 909 (Taiwan) on Acute Toxicity

Groups	Number	Dosage (oral) mg/kg Body wt.	Ratio of Dead and Tested	% of Death
1	5	Distilled water	0/5	0%
2	5	Ethanol extract 0.5 g/kg body wt.	0/5	0%
3	5	Ethanol extract 1.0 g/kg body wt.	0/5	0%
4	5	Ethanol extract 1.5 g/kg body wt.	0/5	0%
5	5	Ethanol extract 2.0 g/kg body wt.	0/5	0%
6	5	Ethanol extract 2.5 g/kg body wt	0/5	0%

Diet = Stock diet & distilled water

Observation period= one week

It was found that all mice were alive when even 2.5 g of ethanol extract from the fruits of *L. esculentum* Mill. cv. 909 (Taiwan) was given to the mice. Therefore, the LD₅₀ of the extract supposed to be much more than 2.5 g/kg body weight.

Determination of Hypoglycemic Activity of Ethanol Extracts from the Fruits of *Lycopersicon esculentum* Mill. cv. local and cv. 909(Taiwan)

Blood Glucose Concentration of Normal Mice

The mean blood glucose concentration of the four albino mice at 0 min, 45 min, 90 min, 135 min, 180 min and 225 min after subcutaneous injection of adrenaline tartrate were 82.75±25.12 mg/dL, 110±12.25 mg/dL, 107.5±15.02 mg/dL, 100.25±12.52 mg/dL, 98.75±9.91 mg/dL and 87.25±14.41 mg/dL (Table 4).

Table 4 Blood Glucose Concentration of Normal Mice

Mouse code	Blood glucose concentration (mg/dL)					
	0 min	45 min	90 min	135 min	180 min	225 min
1	47	123	124	89	105	70
2	84	104	101	109	109	101
3	103	117	115	113	98	102
4	97	96	90	90	83	76
Sum	331	440	430	401	395	349
Mean	82.75	110	107.5	100.25	98.75	87.25
SD	25.12	12.25	15.02	12.52	9.91	14.41
SEM	12.56	6.125	7.51	6.26	4.955	7.205

The maximum blood glucose concentration was found at 45 minutes and blood glucose level was gradually decreased from 90 minutes to 225 minutes.

Effect of Distilled Water on the Adrenaline-induced Hyperglycemic Albino Mice

The mean blood glucose concentration of the four albino mice at 0 min, 45 min, 90 min, 135 min, 180 min and 225 min after subcutaneous injection of adrenaline tartrate were 80.75 ± 24.25 mg/dL, 189.5 ± 53.81 mg/dL, 157.75 ± 30.97 mg/dL, 81.0 ± 31.18 mg/dL, 65.25 ± 23.76 mg/dL and 76 ± 9.97 mg/dL (Table 5).

Table 5 Effect of Distilled Water on the Blood Glucose Concentration of Individual Adrenaline-induced Hyperglycemic Mice

Mouse code	Blood glucose concentration (mg/dL)					
	0 min	45 min	90 min	135 min	180 min	225 min
1	50	213	156	60	41	76
2	85	179	124	98	88	89
3	79	120	152	50	42	61
4	109	246	199	116	90	78
Sum	323	758	631	324	261	304
Mean	80.75	189.5	157.75	81.0	65.25	76
SD	24.25	53.81	30.97	31.18	23.76	9.97
SEM	12.125	26.905	15.485	15.59	11.88	4.985

The blood glucose concentrations were found to increase at 45 minutes after injection of adrenaline tartrate and gradually decrease from 90 minutes to 180 minutes. Increase in blood glucose concentration was found at 225 minutes.

Effect of Standard Drug, Glibenclamide 0.5 mg/kg ($0.5 \times 10^{-3} \text{ g/kg}$) on the Adrenaline Induced Hyperglycemic Albino Mice

The mean blood glucose concentration of the four albino mice treated with standard drug, glibenclamide $0.5 \times 10^{-3} \text{ g/kg}$ at 0 min, 45 min, 90 min, 135 min, 180 min and 225 min after subcutaneous injection of adrenaline tartrate $0.2 \times 10^{-3} \text{ g/kg}$ were found to be 81.5 ± 25.67 mg/dL, 100.75 ± 50.11 mg/dL, 61 ± 29.98 mg/dL, 54.5 ± 18.12 mg/dL, 76.25 ± 13.48 mg/dL and 85.25 ± 18.50 mg/dL (Table 6).

The decrease in blood glucose concentration was found after 45 minutes and increase after 135 minutes.

Table 6 Effect of Standard Glibenclamide on Blood Glucose Concentration of Individual Adrenaline Induced Hyperglycemic Mice

Mouse code	Blood glucose concentration (mg/dL)					
	0 min	45 min	90 min	135 min	180 min	225 min
1	90	82	55	51	83	113
2	111	149	83	55	86	82
3	50	39	21	34	53	61
4	75	133	85	78	83	85
Sum	326	403	244	218	305	341
Mean	81.5	100.75	61	54.5	76.25	85.25
SD	25.67	50.11	29.98	18.12	13.48	18.50
SEM	12.835	25.055	14.99	9.06	6.74	9.25

Effect of Ethanol Extract from the Fruits of *Lycopersicon esculentum* Mill. cv. local 4g/kg on Adrenaline Induced Hyperglycemic Mice

The mean blood glucose concentration of the four albino rats treated with ethanol extract from the fruits of *L. esculentum* Mill. cv. local (4g/kg) at 0 min, 45 min, 90 min, 135 min, 180 min and 225 min after subcutaneous injection of adrenaline tartrate 0.2×10^{-3} g/kg were 80.5 ± 36.19 mg/dL, 161 ± 99.54 mg/dL, 94.75 ± 62.63 mg/dL, 50.75 ± 31.36 mg/dL, 35.25 ± 16.78 mg/dL and 37 ± 8.75 mg/dL (Table 7).

Table 7 Effect of Ethanol Extract from the Fruits of *Lycopersicon esculentum* Mill. cv. local on Blood Glucose Concentration of Individual Adrenaline-induced Hyperglycemic Mice

Mouse code	Blood glucose concentration (mg/dL)					
	0 min	45 min	90 min	135 min	180 min	225 min
1	130	253	174	97	62	41
2	54	195	107	42	37	44
3	53	20	25	28	20	22
4	85	176	73	36	22	41
Sum	322	644	379	203	141	148
Mean	80.5	161	94.75	50.75	35.25	37
SD	36.19	99.54	62.63	31.36	16.78	8.75
SEM	18.095	49.77	31.315	15.68	8.39	4.375

The decrease in blood glucose concentration was found after 45 minutes. Maximum decrease was found at 180 minutes.

Effect of Ethanol Extract from the Fruits of *Lycopersicon esculentum* Mill. cv. 909 (Taiwan) 4g/kg on Adrenaline- induced Hyperglycemic Mice

The mean blood glucose concentration of the four albino mice treated with ethanol extract from the fruits of *L.esculentum* Mill. cv.909(Taiwan) 4g/kg at 0 min, 45 min, 90 min, 135 min, 180 min and 225 min after subcutaneous injection of adrenaline tartrate 0.2×10^{-3} g/kg were 81.5 ± 29.59 mg/dL, 220.25 ± 178.65 mg/dL, 156.25 ± 105.81 mg/dL, 72.25 ± 49.01 mg/dL, 68 ± 32.23 mg/dL and 64.5 ± 27.13 mg/dL (Table 8).

The highest blood glucose concentration was found at 45 minutes and gradually decreased at 225 minutes.

Table 8 Effect of Ethanol Extract from the Fruits of *Lycopersicon esculentum* Mill. cv. 909 (Taiwan) on Blood Glucose Concentration of Individual Adrenaline- induced Hyperglycemic Mice

Mouse code	Blood glucose concentration (mg/dL)					
	0 min	45 min	90 min	135 min	180 min	225 min
1	70	158	144	60	72	86
2	120	475	302	143	119	93
3	86	189	130	56	37	25
4	50	59	49	30	44	54
Sum	326	881	625	289	272	258
Mean	81.5	220.25	156.25	72.25	68	64.5
SD	29.59	178.65	105.81	49.01	32.23	27.13
SEM	14.795	89.325	52.905	24.505	16.115	13.565

Comparison Between Control, Treatments and Normal Groups

Mean blood glucose concentration of three mice groups such as glibenclamide, extract cv. local and cv. 909(Taiwan) were compared with that of control and presented in Table 9-11.

Table 9 Mean Blood Glucose Concentration of Control and Standard Drug, Glibenclamide on Adrenaline-induced Hyperglycemic Mice

Group of mice (n=4)	Blood Glucose Level (mg/dL)					
	0 min	45 min	90 min	135 min	180 min	225 min
Control	80.75	189.5	157.75	81.0	65.25	76
Glibenclamide	81.5	100.75	61.00*	54.50	76.25	85.25

Results were expressed mean . *P <0.05, *= significant (P<0.05)

Table 10 Mean Blood Glucose Concentration of Control and Ethanol Extract from the Fruits of *Lycopersicon esculentum* Mill. cv. local on Adrenaline-induced Hyperglycemic Mice

Group of mice (n=4)	Blood Glucose Level (mg/dL)					
	0 min	45 min	90 min	135 min	180 min	225 min
Control	80.75	189.5	157.75	81.0	65.25	76
Extract cv local	80.5	161.00	94.75*	50.75	35.25	37.00*

Results were expressed mean . *P <0.05, *= significant (P<0.05)

Table 11 Mean Blood Glucose Concentration of Control and Ethanol Extract from the Fruits of *Lycopersicon esculentum* Mill. cv. 909 (Taiwan) on Adrenaline-induced Hyperglycemic Mice

Group of mice (n=4)	Blood Glucose Level (mg/dL)					
	0 min	45 min	90 min	135 min	180 min	225 min
Control	80.75	189.5	157.75	81.0	65.25	76
Extract cv. 909 (Taiwan)	81.5	220.25	156.25	72.25	68.00	64.50

Results were expressed mean . *P <0.05, *= significant (P<0.05)

At 45 min after subcutaneous injection of adrenaline tartrate, glibenclamide gave the lowest blood glucose level. Significant decrease in blood glucose level of glibenclamide was found at 90 min (p<0.05) when compared with that of the control. Significant decrease in blood glucose level of extract cv. local were found at 90 min (p<0.05) and 225 min (p<0.05) when compared with that of the control. The blood glucose levels of extract cv. 909(Taiwan) were similar to that of control.

Percent Reduction of Hyperglycemia

Glibenclamide 0.5×10^{-3} g/kg gave percent reduction of hyperglycemia 39.45% for 90 minutes, 45.91% for 135 minutes, 24.32% for 180 minutes and 15.38% for 225 minutes.

Ethanol extract from the fruits of *L. esculentum* Mill. cv. local (4g/kg) shows percent reduction of hyperglycemia 41.15% for 90 minutes, 68.48% for 135 minutes, 78.11% for 180 minutes and 77.02% for 225 minutes.

Ethanol extract from the fruits of *L. esculentum* Mill. cv.909 (Taiwan) (4g/kg) shows percent reduction of hyperglycemia 29.06% for 90 minutes, 67.2% for 135 minutes, 69.13% for 180 minutes and 70.72% for 225 minutes.

Comparison of Percent Reduction of Hyperglycemia Between Ethanol Extracts from the Fruits of *Lycopersicon esculentum* Mill. cv. local and cv. 909 (Taiwan) and Standard Drug, Glibenclamide

Percent reduction of hyperglycemia between ethanol extract from the fruits of *L. esculentum* Mill. cv. local and cv. 909 (Taiwan) and standard drug, glibenclamide were compared each 45 minutes starting from 90 minutes. The results were shown in Table 12 and 13.

The percent reduction of ethanol extract from the fruits of *L. esculentum* Mill. cv. local increase from 135 minutes (68.48%) to 180 minutes (78.11%). The maximum percent reduction was found at 180 minutes (78.11%). After maximum condition, percent reduction decreased at 225 minutes (77.02%).

The percent reduction of ethanol extract from the fruits of *L. esculentum* Mill. cv. 909 (Taiwan) increase from 90 minutes (29.06%) to 225 minutes (70.72%).

The maximum percent reduction of glibenclamide was found at 135 minutes (45.91%) and gradually decreased up to 225 minutes (15.38%).

From the above observation, ethanol extracts of cv. local and cv. 909 (Taiwan) are more tendency to the reduction of hyperglycemia than glibenclamide. Besides, ethanol extract of cv. local can be reduce hyperglycemia better than that of cv. 909 (Taiwan).

Table 12 Comparison Between Blood Glucose Concentration (\pm SD) of Control Treatments and Normal Groups

Group of mice (n=4)	Blood Glucose Level (mg/dL)					
	0 min	45 min	90 min	135 min	180 min	225 min
Control	80.75 \pm 24.25	189.5 \pm 53.81	157.75 \pm 30.97	81.0 \pm 31.18	65.25 \pm 23.76	76 \pm 9.97
Glibenclamide	81.5 \pm 25.67	100.75 \pm 50.11	61.00 \pm 29.98*	54.50 \pm 18.12	76.25 \pm 13.48	85.25 \pm 18.50
Extract cv local	80.5 \pm 36.19	161.00 \pm 99.54	94.75 \pm 62.63*	50.75 \pm 31.36	35.25 \pm 16.78	37.00 \pm 8.75*
Extract cv 909(Taiwan)	81.5 \pm 29.59	220.25 \pm 178.65	156.25 \pm 105.81	72.25 \pm 49.01	68.00 \pm 32.23	64.50 \pm 27.13
Normal	82.75 \pm 25.12	110 \pm 12.25	107.5 \pm 15.02	100.25 \pm 12.52	98.75 \pm 9.91	87.25 \pm 14.41

Results were expressed as Mean \pm SD *P < 0.05

Student's 't' test is significant at P < 0.05 , *= significant (P< 0.05)difference compared to control.

Table 13 Percent Reduction of Ethanol Extract from the Fruits of *L. esculentum* Mill. cv local and cv. 909(Taiwan) and Glibenclamide on Adrenaline- induced Hyperglycemic Mice

Group of mice (n=4)	Percent reduction of hyperglycemia (%)			
	90 min	135 min	180 min	225 min
Extract cv local (4g/kg)	41.15	68.48	78.11	77.02
Extract cv 909(Taiwan) (4g/kg)	29.06	67.20	69.13	70.72
Glibenclamide (0.5 mg/kg)	39.45	45.91	24.32	15.38

Discussion and Conclusion

Lycopersicon esculentum Mill. are widely cultivated through the tropical region of Myanmar. It is one of the species in Solanaceae family. In the present work, the morphological, nutritional values and hypoglycemic activities of *Lycopersicon esculentum* Mill. cv. local and cv. 909 (Taiwan) were presented.

In morphological studies, cv. local is annual herbs and the stems are branches terete, hispid. Leaves are imparipinnate compound, basally lyrate, hispid on both surfaces. These characters are in agreement with those mentioned by Dassanayake (1987).

The habits of *Lycopersicon esculentum* Mill. cv. 909 (Taiwan) is annual erect herbs and stems are branches, pubescent. Leaves imparipinnate compound, basally lyrate and pubescent on both surfaces. These characters are agreed with those given by Dassanayake (1987).

For cv. local, ovary is ovoid, bilocular and many ovules in each locule on the axile placentae. The fruits are berry, globoid or ovoid scarlet when ripe. Which are in agreement with those given by Hooker (1885).

For cv. 909 (Taiwan), ovary is oblong and bilocular with many ovules on the axile placentae. Fruits is berry, oblongoid or ovoid, many seeded, scarlet when ripe. These characters are agreed with those mentioned by Hooker (1885).

According to the results, the water content in cv. 909 (Taiwan) was found to be 89.06% and that in cv. local was 91.17%. The cv. 909 (Taiwan) contains 1.5% fat and 2.25% was found in cv. local. The water and fat content in cv. 909 (Taiwan) sample was smaller than that of cv. local. These amounts were agreed with those mentioned by Gupta (2011). The carbohydrate content of the cv. 909 (Taiwan) was 61.8% and that of cv. local was 56.4%. The amount of crude fiber of cv. 909 (Taiwan) was 23.1% and cv. local contains 19.9%. The amount of protein in cv. 909 (Taiwan) was 18.25% and that of cv. local was 16.17%. These data are agreement with those given by Nispetiye (2009).

In pharmacological studies, the acute toxicity and hypoglycemia effect of the fruits of *L. esculentum* Mill. cv. local and cv. 909(Taiwan) were investigated. From the acute toxicity determination with mice model, there were no lethal effect was observed with maximum permissible dose of 2.5 g/kg body weight. Therefore, the medium lethal dose, LD₅₀ of the extracts supposed to be much more than 2.5 g/kg body weight per mice orally. The ethanol

extracts of *L. esculentum* Mill. cv. local and cv. 909(Taiwan) showed harmless effect on the albino mice. It is clear that ethanol extracts of tomato were free from acute toxic effect.

According to Wilde (2012), tomato contains a substance called lycopene. Tomatoes also contain vitamin C and vitamin E. The tomato can be used for diabetes management. Controlling blood sugar level is an important part of diabetes management.

Adrenaline was used to induce hyperglycemia in albino mice and blood glucose concentrations were measured at different times (each 45 minutes) according to the method of Malpani *et al.* (2010).

It was evident that for the mice treated with glibenclamide, significant decrease in blood glucose level was found at 90 min ($p < 0.05$) when compared with that of the control. For the mice treated with ethanol extract from the fruits of *L. esculentum* Mill. cv. local, significant decrease in blood glucose level were found at 90 min ($p < 0.05$) and 225 min ($p < 0.05$) when compared with that of the control.

From the comparison of percent reduction of hypoglycemia, the percent reduction of glibenclamide was gradually decreased from 135 minutes to 225 minutes. For the ethanol extracts from the fruits of *L. esculentum* Mill. cv. local, the percent reduction was increased from 45 min to 180 minutes but decreased at 225 minutes. The percent reduction of ethanol extract from the fruits of *L. esculentum* Mill. cv. 909(Taiwan) increase from 90 minutes to 225minutes.

The ethanol extract of cv. local can be maximum percentage at 180 minutes (78.11%). After that, the blood glucose concentration gradually decrease (percent reduction decrease). The ethanol extract of cv. local has more tendency to the reduction of hyperglycemia than glibenclamide.

From the comparison of two cultivars, ethanol extract of cv. local shows higher hyperglycemic activity than that of cv. 909(Taiwan).

Diabetes is one of the most prevalence chronic diseases in the world. In this research work, the extracts of *L. esculentum* Mill. cv. local and cv. 909(Taiwan) respond hypoglycemic effect in diabetic mellitus at short period of dietary intake and there is no toxic effect. Therefore, the consumers may benefit by eating tomatoes.

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